

Package ‘KENDL’

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Type Package

Title Kernel-Smoothed Nonparametric Methods for Environmental Exposure
Data Subject to Detection Limits

Version 1.1

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Description Calculate the kernel-smoothed nonparametric estimator for the exposure distribution in presence of detection limits.

License GPL-2

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KENDL-package	<i>Kernel-smoothed Nonparametric Methods for Environmental Exposure Data Subject to Detection Limits</i>
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Description

Calculate the kernel-smoothed nonparametric estimator for the exposure distribution in presence of detection limits.

Details

Package: KENDL
 Type: Package
 Version: 1.0
 Date: 2017-03-13
 License: GPL-2

Author(s)

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KRKM

Calculate the exposure distribution in the presence of detection limits

Description

Calculate the exposure distribution based on the kernel reverse Kaplan-Meier(KRKM) estimator proposed by Yang et al. (2017).

Usage

```
KRKM(obs, bdl, lod, method='formula', b=1000)
```

Arguments

obs	A vector of observations which are the exposure levels if the subject's exposure level can be detected, and the detection limits otherwise.
bdl	A logical vector indicating TRUE if the subject's exposure level is below the detection limit, and FALSE otherwise.
lod	A vector of detection limits.
method	The method of variance estimation. Either 'formula' or 'bootstrap' can be used. The default value is 'formula'.
b	The number of bootstrap replicates for the bootstrap-based variance estimation method. The default value is 1000.

Details

The KRKM estimator is a nonparametric estimator for the exposure distribution. It is valid regardless of whether the exposure level and detection limit are independent or not. This method requires the data come from simple random sampling and the detection limit is available for each subject. This function provides either formula-based or bootstrap-based variance estimation. The formula-based variance estimation method is computationally faster than the bootstrap-based method, but may underestimate the variance and thus yield poor coverage probabilities at the points below which there are few observations.

Value

unique.obs	A vector of unique observations in the argument obs.
cdf	A vector of estimates for the cumulative distribution function (cdf) at the points given by unique.obs.
se	A vector of standard error estimates for the cdf estimates
lower	A vector of 95% lower confidence limits of the cdf values
upper	A vector of 95% upper confidence limits of the cdf values

Author(s)

Yuchen Yang, Li Chen

References

Yang Y, Shelton BJ, Tucker TC, Li L, Kryscio RJ, Chen L. (2017). Estimation of Exposure Distribution Adjusting for Association between Exposure Level and Detection Limit. *Statistics in Medicine*. Provisionally Accepted.

See Also

plot.KRKM

Examples

```
# simulated data set from a lognormal regression model
lod <- exp(rnorm(200, -2.79, 1.12))
e <- rnorm(200, 0, 1.21)
t <- exp(-3.05+0.42*lod+e)
obs <- pmax(t, lod)
bd1 <- t<lod
# KRKM estimator
fit <- KRKM(obs=obs, bd1=bd1, lod=lod)
```

plot.KRKM

Plot method for KRKM objects

Description

Plot the estimated cumulative distribution function obtained by the KRKM function.

Usage

```
## S3 method for class 'KRKM'
plot(x, conf.int = TRUE, lty = 1, col = 1, lwd=1, xlim=NULL, ylim =
NULL, log="x", xlab = NULL, ylab = "CDF", ...)
```

Arguments

<code>x</code>	An object of class KRKM which is returned by the KRKM function.
<code>conf.int</code>	Determines whether confidence intervals will be plotted. The default value is TRUE.
<code>lty</code>	An integer specifying line type. The default value is 1.
<code>col</code>	An integer specifying color type. The default value is 1.
<code>lwd</code>	A numeric value specifying line width. The default value is 1.
<code>xlim</code>	A vector specifying the lower and upper boundaries for x values.
<code>ylim</code>	A vector specifying the lower and upper boundaries for y values.
<code>log</code>	One of the standard character strings "x", "y", or "xy" to specify logarithmic horizontal and/or vertical axes. The default value is "x". Use <code>log=""</code> to specify no logarithmic scale used for either horizontal or vertical axes.
<code>xlab</code>	Label given to the x-axis with NULL as default.
<code>ylab</code>	Label given to the y-axis with "CDF" as default.
<code>...</code>	Other arguments allowed for the general <code>plot</code> function.

Author(s)

Yuchen Yang, Li Chen

See Also

KRKM

Examples

```
# simulated data set from a lognormal regression model
lod <- exp(rnorm(200, -2.79, 1.12))
e <- rnorm(200, 0, 1.21)
t <- exp(-3.05+0.42*lod+e)
obs <- pmax(t, lod)
bd1 <- t<lod
# KRKM estimator
fit <- KRKM(obs=obs, bd1=bd1, lod=lod)
plot(fit)
```

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